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## **CLAIMS**

What is claimed is:

1	1. A structure in an integrated circuit, said
2	structure extending from a conductive surface through
3	a channel having inner walls extending above said
4	conductive surface, said structure comprising:
5	a layer of a refractory metal residing on said
6	conductive surface and said inner walls of said
7	channel; and
8	a layer of a metal nitride residing on said layer
9	of said refractory metal, wherein said layer of said
10	metal nitride has a thickness extending from said layer
11	of said refractory metal of less than 130 Å.
1	2. The structure of claim 1, wherein said layer

- 2. The structure of claim 1, wherein said layer of said metal nitride has a thickness in the range of 25 to 75 Å.
- 3. The structure of claim 1, wherein said layer of said refractory metal and said layer of said metal nitride have a combined thickness extending from said inner walls of said channel of less than 200 Å.
- 1 4. The structure of claim 1, wherein said 2 structure has a width that is less than or equal to

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3 3,000 Å.

1.	5. The structure of claim 1, wherein a ratio of
2	a height of said structure to a width of said structure
3	is greater than or equal to 3.33.

- 1 6. The structure of claim 1, wherein said layer
  2 of said refractory metal has a thickness extending from
  3 said inner walls of said channel in a range of 25 to
  4 100 Å.
- o∕£ claim 1, wherein The structure 7. 1 refractory metal is a metal selected from the group 2 cobalt and tantalum, titanium, consisting of 3 molybdenum. 4
  - 8. The structure of claim 1, wherein said metal nitride has a resistivity of less than 600  $\mu\Omega$ -cm.
- 9. The structure of claim 1, wherein said metal nitride includes a metal selected from the group consisting of titanium, zirconium, hafnium, tantalum, molybdenum and tungsten.
- 1 10. The structure of claim 1, further including: 2 a layer of a metal residing on said layer of said

- 3 metal nitride.
- 1 11. The structure of claim 10 wherein said metal
- 2 nitride is adhesive to said metal.
- 1 12. The structure of claim 10, wherein said metal
- 2 is tungsten.
- 1 13. The structure of claim 10, wherein said
- 2 structure has a resistance less than or equal to 3.0  $\Omega$ .
- 1 14. The structure of claim 13, wherein said
- 2 channel has an aspect ratio grater than or equal to
- 3 3.33.
- 1 15. A structure/in an integrated circuit, said
- 2 structure extending from a conductive surface
- 3 surrounded by a channel having inner walls extending
- 4 from said conductive surface, said structure
- 5 comprising:
- a layer of a refractory metal having a thickness in
- 7 a range of about 25 to 100 Å residing on said
- 8 conductive surface and said inner walls of said
- 9 channel; and
- a layer of a metal nitride residing on said layer
- of said refractory metal, wherein said layer of said

- metal nitride has a thickness extending from said layer
  of said refractory metal of less than 130 Å.
  - 1 16. The structure of claim 15/ wherein said layer 2 of said metal nitride has a thickness in the range of 3 25 to 75 Å.
  - 1 17. The structure of claim 15, wherein said layer
    2 of said refractory metal and said layer of said metal
    3 nitride have a combined thickness extending from said
    4 inner walls of said channel of less than 175 Å.
  - 1 18. The structure of claim 15, wherein said 2 channel has an aspect ratio greater than or equal to 3 3.33.
  - 1 19. The structure of claim 15, wherein said 2 refractory metal is a metal selected from the group 3 consisting of titanium, tantalum, cobalt, and 4 molybdenum.
  - 1 20. The structure of claim 15, wherein said metal 2 nitride includes a metal selected from the group 3 consisting of titanium, zirconium, hafnium, tantalum, 4 molybdenum and tungsten.

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21. A method for forming a structure in an integrated circuit, said structure extending from a conductive surface through a channel having inner walls extending above said conductive surface, said method including the steps of:

- (a) depositing a layer of a refractory metal on said conductive surface and said inner walls of said channel; and
- 9 (b) forming a layer of a metal nitride on said
  10 layer of said refractory metal, wherein said layer of
  11 said metal nitride has a thickness extending from said
  12 layer of said refractory metal of less than 130 Å.
  - 1 22. The method of claim 21, wherein said layer of 2 said metal nitride has a thickness in the range of 25 3 to 75 Å.
  - 1 23. The method of claim 21, wherein said layer of said refractory metal and said layer of said metal nitride have a combined thickness extending from said inner walls of said channel of less than 200 Å.
  - 1 24. The method of claim 21, wherein said step (b) 2 includes the steps of:
  - depositing said metal nitride on said layer of said refractory metal; and

plasma annealing said metal nitride.

25. The method of claim 24, wherein said step of plasma annealing includes the steps of:

- exposing said metal nitride to an environment
- 4 containing ions; and

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- 5 electrically biasing said layer of said metal
- 6 nitride to cause said ions from said environment to
- 7 impact said metal nitride.
- 1 26. The method of claim 25, wherein said step of
- 2 exposing said metal nitride to said environment
- 3 containing ions includes the steps of:
- 4 providing a gas; and
- 5 providing a first rf signal to a first electrode on
- 6 a first side of a wafer on which said structure is
- 7 being formed to provide energy to said gas.
- 1 27. The method of claim 26, wherein said gas
- 2 contains at least one gas selected from the group
- 3 consisting of nitrogen, hydrogen, argon, helium, and
- 4 ammonia.
- 1 28. The method of claim 26, wherein said metal
- 2 nitride includes at least one material selected from
- 3 the group consisting of titanium, tantalum, tungsten,

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- 4 hafnium, molybdenum, and zirconium.
- 1 29. The method of claim 26, wherein said gas
- 2 includes a noble gas.
  - 30. The method of claim 24, wherein said step of depositing said metal nitride and said step of plasma annealing are both performed in a single chamber and without removing a wafer on which said structure is being formed from the chamber between beginning said step of depositing said metal nitride and completion of said step of plasma annealing.
- 31. The method of claim 24, wherein said step of depositing said metal nitride is performed using chemical vapor deposition.
- 1 32. The method of claim 24, wherein said step of 2 plasma annealing includes the steps of:
- performing a first plasma annealing of said metal nitride; and
- 5 performing a second plasma annealing of said metal 6 nitride after performing said first plasma annealing.
- 1 33. The method of claim 32, wherein said step of 2 performing said first plasma annealing includes the

- 3 steps of:
- 4 exposing said metal nitride to a first environment
- 5 containing ions; and
- 6 electrically biasing said metal nitride to cause
- 7 said ions from said first environment to impact said
- 8 metal nitride.
- 1 34. The method of claim 33, wherein said step of
- 2 performing said second plasma annealing includes the
- 3 steps of:
- 4 exposing said metal nitride to a second environment
- 5 containing ions; and
- 6 electrically biasing said metal nitride to cause
- 7 said ions from said second environment to impact said
- 8 layer of said metal nitride.
- 1 35. The method of claim 34, wherein said step of
- 2 exposing said metal nitride to a first environment
- 3 containing ions includes the steps of:
- 4 providing a first gas, and
- 5 providing energy to said first gas to generate a
- 6 first plasma, and
- 7 wherein said step of exposing said metal nitride to
- 8 a second environment containing ions includes the steps
- 9 of:
- 10 providing a second gas, and

- providing energy to said second gas to generate a
- 12 second plasma.
  - 1 36. The method of claim 35, wherein said first gas
- 2 contains at least one gas selected from the group
- 3 consisting of nitrogen, hydrogen, argon, helium, and
- 4 ammonia.
- 1 37. The method of claim 35, wherein said second gas
- 2 contains at least one gas selected from the group
- 3 consisting of nitrogen, helium, neon, and argon.
- 1 38. The method of claim of claim 32, wherein said
- 2 step of depositing said metal nitride is performed
- 3 using chemical vapor deposition.
- 1 39. The method of claim 32, wherein said step of
- 2 depositing said metal nitride and said step of plasma
- 3 annealing are both performed in a chamber without
- 4 removing a wafer on which said structure is being
- 5 formed from the chamber between initiating said step of
- 6 depositing said metal nitride and completing said step
- 7 of plasma annealing.
- 1 40. The method of claim 21, wherein said channel
- 2 has a width less than or equal to 3,000 Å.

- 1 41. The method of claim 21, wherein said channel
- 2 has an aspect ratio that is greater than or equal to
- 3 3.33.
- 1 42. The method of claim 21, wherein said
- 2 refractory metal is deposited in said step (a) by
- 3 physical vapor deposition.
- 1 43. The method of claim 21, wherein said
- 2 refractory metal is deposited in said step (a) by
- 3 chemical vapor deposition.
- 1 44. The method of claim 43, wherein said
- 2 refractory metal is a metal selected from the group
- 3 consisting of titanium, tantalum, cobalt, and
- 4 molybdenum.
- 1 45. The method of claim 21, further including the
- 2 step following said step (b) of:
- 3 (c) depositing a layer of a metal on said layer
- 4 of said metal nitride.
- 1 46. The method of claim 45, wherein said metal is
- 2 tungsten.

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- 1 47. The method of claim 46, further including the 2 step following said step (c) of:
- (d) etching said layer of said refractory metal, said layer of said metal nitride, and said layer of said metal to decompose portions of said layer of said refractory metal, said layer of said metal nitride, and said layer of said metal that reside outside of said channel.
- 1 48. A method for forming a barrier layer over a conductive surface surrounded by a channel having inner 3 walls extending above said conductive surface, said 4 method including the steps of:
  - (a) depositing a layer of a refractory metal on said conductive surface and said inner walls of said channel to a thickness in a range of about 25 to 100 Å;
  - (b) depositing a layer of a metal nitride on said layer of said refractory metal; and
  - 10 (c) plasma annealing said layer of said metal
    11 nitride, wherein said layer of said metal nitride has
    12 a thickness extending from said layer of said
    13 refractory metal of less than 130 Å after completing
    14 said step (c).
    - 1 49. The method of claim 48, wherein said step (c) 2 includes the steps of:

- 3 providing a gas;
- 4 providing energy to said gas to generate an
- 5 environment containing ions; and
- 6 electrically biasing said metal nitride to cause
- 7 said ions from said environment to impact said metal
- 8 nitride.
- 1 50. The method of claim 49, wherein said metal
- 2 nitride includes at least one material selected from
- 3 the group consisting of titanium, tantalum, tungsten,
- 4 hafnium, molybdenum, and zirconium.
- 1 51. The method of claim 48, wherein said step (c)
- 2 includes the steps of:
- 3 performing a first plasma annealing of said metal
- 4 nitride; and
- 5 performing a second plasma annealing of said metal
- 6 nitride after performing said first plasma annealing.
- 1 52. The method of claim 48, wherein said channel
- 2 has a width less than or equal to 3,000 Å.
- 1 53. The method of claim 52, wherein said channel
- 2 has an aspect ratio that is greater than or equal to
- 3 3.33.